CURRENT LITERATURE

MINOR NOTICES

Handbook of Yosemite National Park.—HALL[1] has edited a volume of information in reference to Yosemite National Park. He has also written the chapter on trees, but the volume is really the combined product of more than a dozen specialists, and appears to be decidedly superior to the handbooks usually available for the guidance of travelers. The ideas and policy of actuating the best minds of the nation in the creation, administration, and use of such parks are admirably set forth by STEPHEN T. MATHER, Director United States National Park Service.

Several professors of the University of California have contributed chapters on their own subjects, KROEBER dealing with the anthropology, LAWSON with the geology, GRINNELL with the animal life and its distribution according to life zones, VAN DYKE with the insects, and JEPSON with the plant life. All these accounts are in attractive style and are scientifically accurate. JEPSON'S chapter on the *Sequoia* seems to be particularly happy in presenting the life problems of these great trees in attractive and accurate form. His treatment of the wild flowers is based upon ecological principles, and here, in common with the other chapters of the book, there is appended a sufficient bibliography to lead the interested traveler or student into the available literature upon the subject.—GEO. D. FULLER.

Plant analysis.—Stechert and Company have recently republished GREENISH'S translation of DRAGENDORF'S Plant analysis, qualitative and quantitative.[2]—WM. CROCKER.

NOTES FOR STUDENTS

Mutation.—For the past two decades the term mutation has held a very prominent place in the vocabulary and thought of biologists, yet most of us have had a very inexact understanding of the phenomena involved. Even now an understanding of the causes is probably quite remote, but at least our

[1] HALL, ANSELL T., Handbook of Yosemite National Park. 12 mo. pp. ix+347. *pls. 27* and map. New York: Putman's Sons. 1921. $2.50.

[2] DRAGENDORF, G., Plant analysis, qualitative and quantitative. pp. vii+280. Translated by HENRY G. GREENISH. 1883.

knowledge of the characteristics of mutation are rapidly becoming more accurate. Mutations were first "discovered" by DE VRIES in *Oenothera Lamarckiana*, and characterized as being qualitative, discontinuous, and constant changes in the germ plasm. These three fundamental characteristics still hold true, but some of DE VRIES' other ideas on the subject have been considerably qualified by later work. For convenience the phenomena may tentatively be classified under five heads. Information has come largely from the published reports of a number of investigators, as indicated, and to some degree is supplemented by papers delivered at the last meetings of the American Association.

1. LOCUS CHANGE.—These are changes restricted to a single locus of one of the chromosomes. Usually they are effective only on one chromosome of a pair, without affecting the corresponding locus of its allelomorphic mate. Consequently the change first appears in the heterozygous condition. BAUR[3] estimates that such changes originate in the heterozygous condition 400 times as frequently as in the homozygous. These are mostly "loss" mutations and recessive to the previous condition. Only a very few dominant or "gain" mutations have been reported. This illustrates the trial and error method by which nature operates, only rarely making those gains which must serve as the basis for progressive evolution. In the fruit-fly these changes take place late in gametogenesis, since only one new individual of the new type appears in a progeny. BAUR, working on *Antirrhinum*, concludes that changes of this sort take place more frequently in the vegetative tissues than in connection with gametogenesis, which should result in large numbers of the new type among the progeny. In this respect it is quite probable that we are dealing with fundamentally different situations in animals, where the germ cells are differentiated so early in ontogeny, and in plants, where the germ cells are merely late products of permanent growing points.

ZELENY[4] states that there is no periodicity to these mutations, thus refuting one of the early ideas of DE VRIES. The same investigator demonstrates that reverse mutations are more frequent than original mutations. This, however, is simply because they are in the reverse direction, and not because of their recent origin. In the case of these reverse mutations, the changes are always full jumps back to the original starting point, and never result in an intermediate condition; nor will the selection of extreme types at all modify the rate at which these reverse mutations occur. In the opinion of the reviewer, however, this does not completely dispose of the possibility of modifying the rate of mutation by selection (it seems quite possible that rate of mutation might fall under the influence of multiple modifying factors).

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[3] BAUR, ERWIN, Mutationen von *Antirrhinum majus*. Zeit. Induct. Abstamm. Vererb. **19**:177–193. *figs. 10*. 1918.

[4] ZELENY, CHARLES, The direction and frequency of mutation in a series of multiple allelomorphs. Anat. Rec. **20**:210–211. 1921.

MULLER and ALTENBURG,[5] who have conducted a critical examination of the fruit-fly for mutations occurring on the first and second chromosomes, state that the vast majority of mutations have a lethal or semilethal effect when present in the homozygous (recessive) condition. It is obvious, therefore, that a critical search for mutations must involve a very special technique. MULLER is in possession of this technique through his intimate knowledge of the linkage groups on the chromosomes in question, and his ability to detect the absence of certain expected classes. On the sex chromosome he uncovered the startling fact that 50 per cent of the mutations were located in a restricted region at one end of the chromosome, which amounted to about 2 per cent of its length as charted from cross-over values. It is an open question whether this indicates a highly mutable region of the chromosome, or whether cross-over values are an inaccurate index of length.

The most promising phase of MULLER'S work arises from this critical study of the rate of mutation. Considering the whole length of the sex chromosome, one mutation occurs in 106 gametes. For the second chromosome the corresponding value is one in 175 gametes. ZELENY states that mutation is as frequent in one sex as in the other. Having established these constants, MULLER is now investigating the possibility of modifying the normal rate of mutation. Already he has been successful in depressing the rate one-half by means of low temperatures. Eventually such work may be of great practical value. A knowledge of the conditions necessary for the maximum rate of mutation should enable the pedigree culturalist to achieve much more rapid results than otherwise.

2. DEFICIENCY.—A rare phenomenon is described by BRIDGES,[6] working on the fruit-fly. This is more extensive than a simple locus change, being a "regional mutation," a loss or "inactivation" of a portion of a chromosome.

3. DUPLICATION.—BRIDGES describes another rare change, and other investigators have suspected similar phenomena. Some abnormal mitosis has resulted in the appearance of an extra piece of chromosome which duplicates in content a known region of the sex chromosome.

4. NON-DISJUNCTION.—This phenomenon, made famous through the classic work of BRIDGES on the sex chromosome of the fruit-fly, may prove to be a fairly common occurrence. In an irregular reduction division one of the chromosomes fails to "disjoin" properly from its mate. As a result, one or two gametes are formed with an extra chromosome, and others which lack this chromosome. The mating of one of the former with a normal gamete would produce a zygote with an extra chromosome. BLAKESLEE, BELLING,

[5] MULLER, H. J., and ALTENBURG, E., A study of the character and mode of origin of eighteen mutations in the *X*-chromosome of *Drosophila*. Anat. Rec. **20**: 213. 1921.

[6] BRIDGES, CALVIN B., Vermilion-deficiency. Jour. Gen. Physiol. **1**:645–656. 1919.

and FARNHAM[7] have discovered this phenomenon in *Datura*. The normal diploid number of chromosomes in this form is twenty-four. Twelve different "mutants" have been discovered with twenty-five chromosomes. This seems to indicate that each of the twelve chromosomes (haploid) has failed to disjoin at least once in history. These twelve new forms are abnormal in their vegetative features, and notably low in fertility.

5. TETRAPLOIDY.—A hurried or incomplete mitosis will sometimes result in the simultaneous duplication of all of the chromosomes. This phenomenon has been observed several times, and there are indications that it has taken place frequently in the past. A general survey of the chromosome counts emphasizes the fact that the haploid number is much more frequently an even number than an odd one. This, together with the fact that there are several species groups in which the chromosome count of some of the members is just twice that of the others, suggests that tetraploidy may have played a considerable rôle in evolution. Tetraploidy commonly, but not always, brings gigantism.

BLAKESLEE now puts the finishing touches on this tetraploidy conception by more work on *Datura*. In addition to the abnormal forms with twenty-five chromosomes, he has discovered one completely triploid (thirty-six) and one tetraploid form. These latter both seem to be in a "better balanced" condition than the non-disjunctional (twenty-five) forms, since they are more "normal" with respect to their vegetative features and fertility. The beauty of the situation arises from the fact that the tetraploid type contains a previously known Mendelian factor. In normal forms a hybrid of the composition *Aa* will give a 3:1 ratio of purple- and white-flowered in the F_2. The tetraploid form *AAaa* gives gametes in the ratio 1 *AA*:4 *Aa*:1*aa*. These recombine to produce an F_2 of 35 purple:1 white. The F_3 and later generations behave according to expectations on this basis.

A question of terminology now arises. Of these various types of germinal changes, it seems the consensus of opinion to restrict the term mutation to the locus change. This is undoubtedly the most frequent type of change to take place, and possibly the most effective single factor in evolution. Deficiencies and duplications are very rare at best. Non-disjunction and tetraploidy are probably fairly common, and the latter is doubtless very important in evolution. These last two (and probably duplication as well) may be referred to collectively as "chromosome aberrations."

All of this differs from mutation as originally described by DE VRIES. This is not surprising in view of the fact that the original example of mutation was not a true case of mutation at all; it now seems certain that *O. Lamarckiana* is a hybrid, and its "mutants" merely recessives being segregated out.

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7 BLAKESLEE, ALBERT F., BELLING, JOHN, and FARNHAM, M. E., Chromosomal duplication and Mendelian phenomena in *Datura* mutants. Science **52**:388–390. 1920.

MULLER[8] deserves the credit for solving this vexing problem. In the fruit-fly he discovered an essentially true-breeding hybrid race, and explained it by a system of balanced lethal factors. These factors assert their lethal effect only when they occur in the homozygous recessive condition. In this race of flies, two such factors are present in heterozygous condition on the same pair of chromosomes, the dominant members of the heterozygous sets being on the opposite chromosomes of the pair. Such a hybrid continues to breed true as such, since any attempt to segregate brings the homozygous recessive condition of one or the other lethal with resulting death to the progeny. The recessives of any heterozygous set on this same chromosome pair will remain concealed when the stock is allowed to inbreed. Occasional crossing-over will cause the appearance of a few (but in predictable frequencies) of these recessives, like the "mutants" thrown by *O. Lamarckiana*.

It is interesting to note that DE VRIES[9] himself now subscribes to an explanation which is fundamentally identical with the preceding. About one-half of the seeds of *O. Lamarckiana* are empty. DE VRIES explains by saying that *Lamarckiana* produces two kinds of gametes, the typical or this *laeta*, and the *velutina*. Each gamete has a lethal factor closely linked with the character factor. Heterozygous combinations give good seeds, homozygous give sterile. If one of the two lethal factors become "vital," the *O. laeta* or *O. velutina* mutation appears.—M. C. COULTER.

Taxonomic notes.—Miss BURLINGHAM[10] has described five new species of *Russula* from Vermont and one from Massachusetts, most of which seem to be rare.

SCHLECHTER[11] has revised two African genera of the Orchidaceae, *Schizochilus* and *Brachycorythis*. In the former genus he recognizes twenty-five species, thirteen of which are new; while in the latter genus twenty-three species are recorded, four of which are new. He also establishes two new genera, *Gyaladenia* and *Diplacorchis*.

MURRILL,[12] in continuation of his investigation of Polypores, has published an account of some of the resupinate forms which are rose-colored, lilac, red, or purple. He presents twenty-six species of *Poria*, five of which are

[8] MULLER, H. J., Genetic variability, twin hybrids, and constant hybrids, in a case of balanced lethal factors. Genetics 3:422–499. *fig.* 1. 1918.

[9] DE VRIES, H., Phylogenetische und gruppenweise Artbildung. Flora 11–12: 208–226. 1918.

[10] BURLINGHAM, GERTRUDE S., Some new species of *Russula*. Mycologia 13: 129–134. *pl.* 7. 1921.

[11] SCHLECHTER, R., Revision der Gattungen *Schizochilus* Sond. und *Brachycorythis* Ldl. Beih. Bot. Centralbl. 38:80–131. 1921.

[12] MURRILL, WILLIAM A., Light-colored resupinate Polypores. III. Mycologia 13:83–100. 1921.